Announcements

- Homework for tomorrow…

  Ch. 31: CQ 10, Probs. 20, 22, & 46

  CQ3: $\Delta V_{12} = 3V$
  31.1: See whiteboard
  31.6: 8V, 22V
  31.8: (48/25)W, (72/25)W

- Office hours…

  MW 10-11 am
  TR 9-10 am
  F 12-1 pm

- Tutorial Learning Center (TLC) hours:

  MTWR 8-6 pm
  F 8-11 am, 2-5 pm
  Su 1-5 pm

Chapter 31

Fundamentals of Circuits

(*Real Batteries & Parallel Resistors*)

Review…

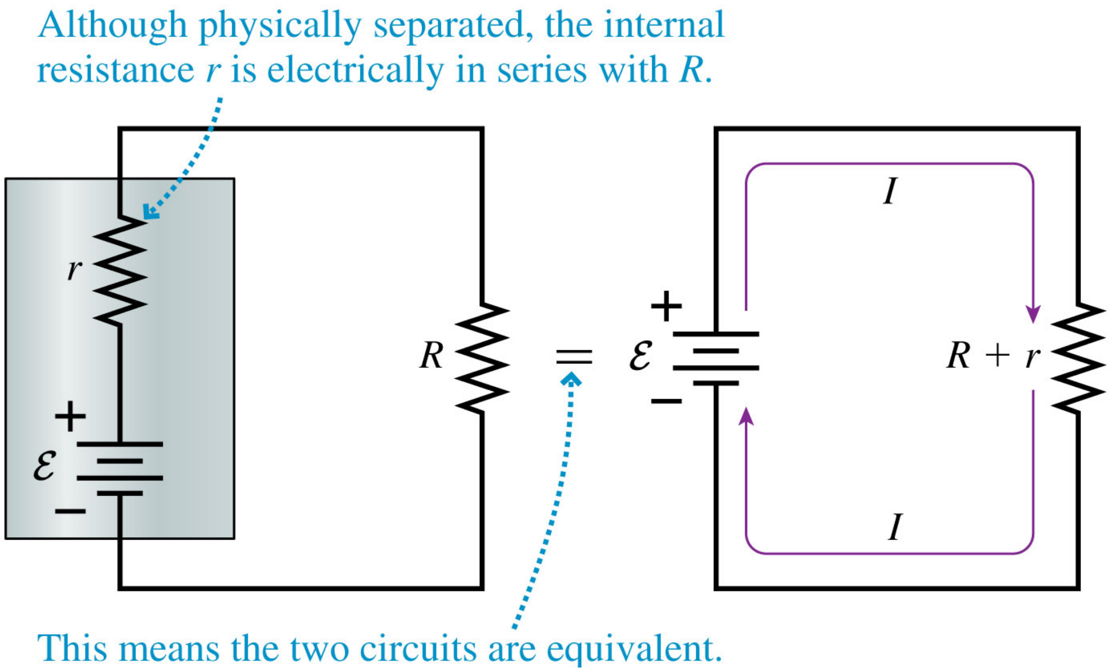
Resistors in *series*….

$$\boxed{R_{eq} = R_1 + R_2 + \ldots}$$

Terminal voltage across a *real* battery…

$$\boxed{\Delta V_{bat} = \mathcal{E} - Ir \leq \mathcal{E}}$$

31.5:
Real Batteries



Notice:

$\Delta V_R = \Delta V_{bat}$, $\Delta V_R \neq \mathcal{E}$

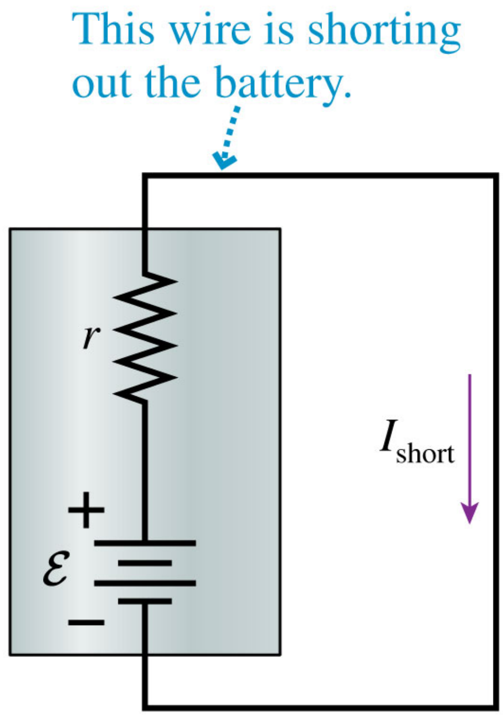
i.e. 31.6: Lighting up a flashlight

A 6.0Ω flashlight bulb is powered by a 3.0V battery with an internal resistance of 1.0Ω.

What are the power dissipation of the bulb and the terminal voltage of the battery?

A Short Circuit…

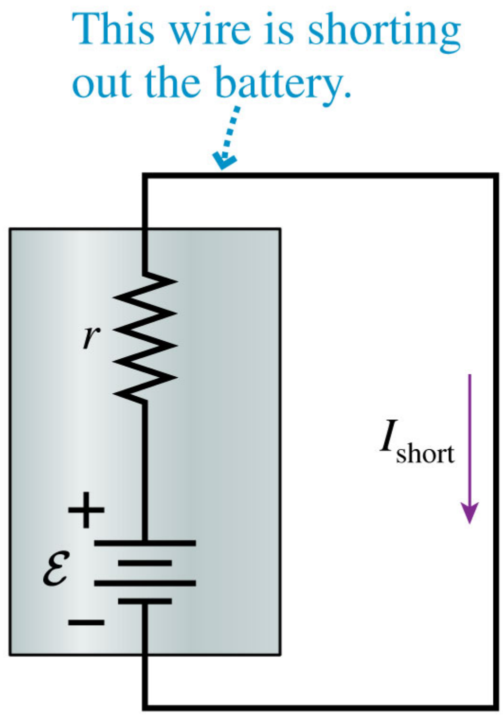
What is the current in this circuit?



A Short Circuit…

What is the current in this circuit?

$$I_{short} = \frac{\mathcal{E}}{r}$$



Notice:

This is the *maximum possible current* that this battery can produce!

i.e. 31.7: A short-circuited battery

What is the short-circuit current of a 12V car battery with an internal resistance of 0.020Ω?

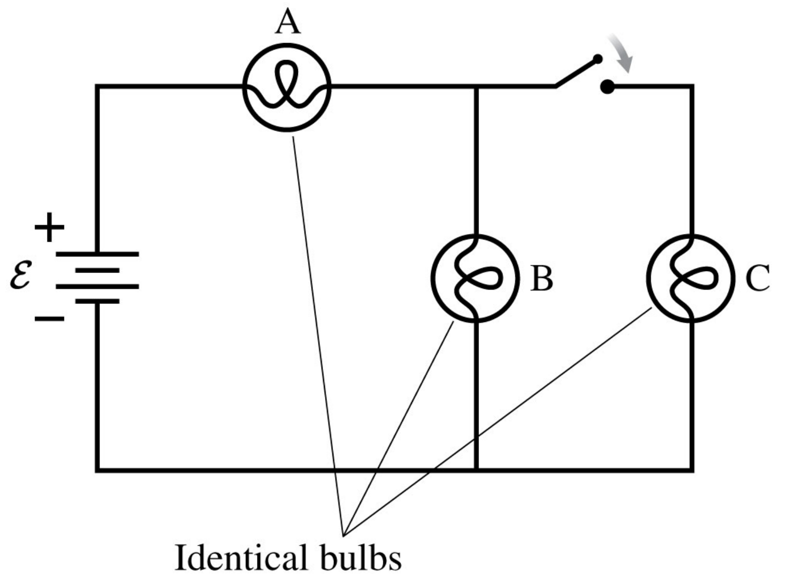
What happens to the power supplied by the battery?

Quiz Question 1

Consider the circuit below, where the switch is open. The current is the same through bulbs A and B, and they are equally bright. Bulb C is not glowing.

The switch is now closed, what happens to the brightness of A?

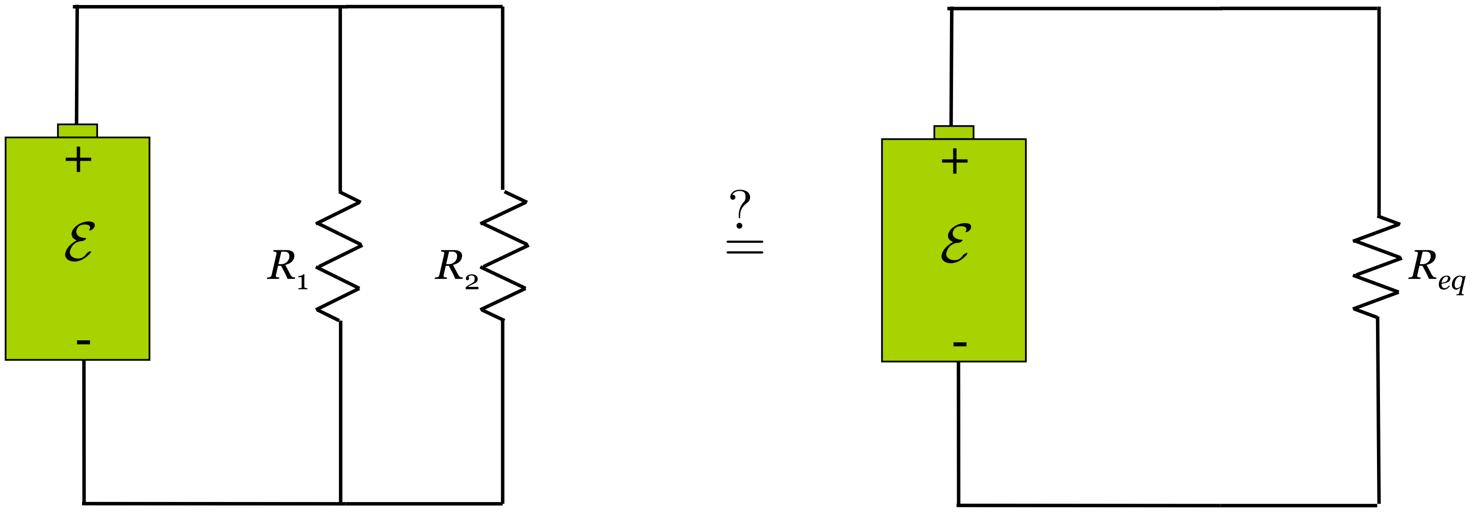
1. It increases.
2. It decreases.
3. It stays the same.



31.6:
Parallel Resistors

Consider two resistors in *parallel*…

- Can we find an *equivalent resistor*, R_{eq}, to the two resistors, R_1 & R_2?



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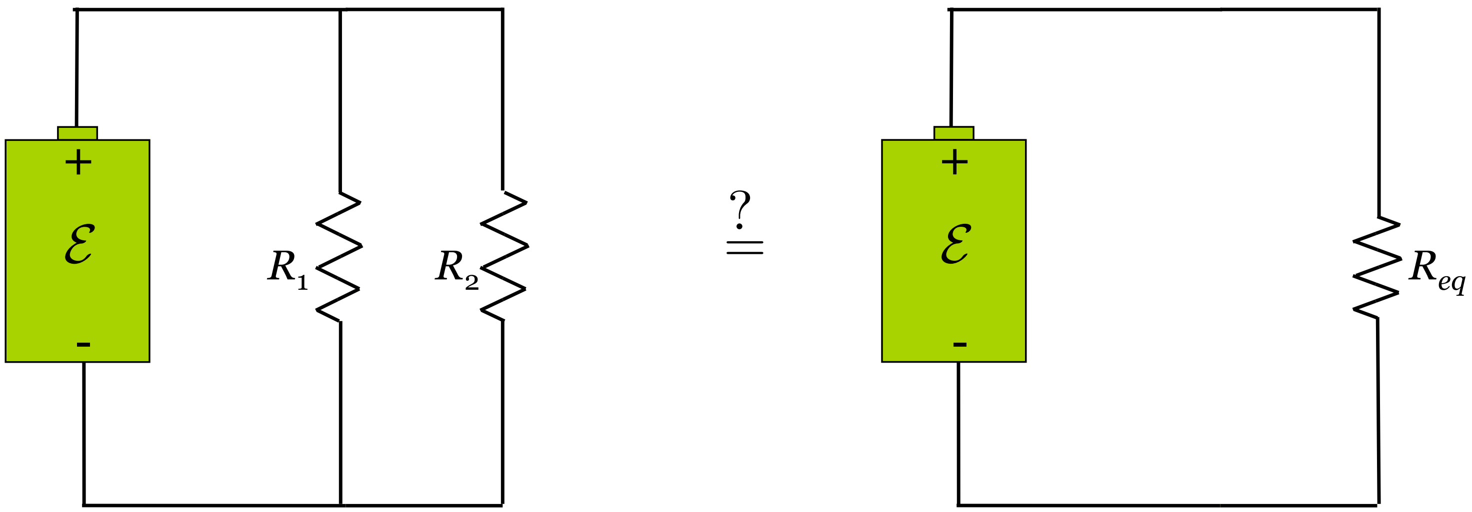


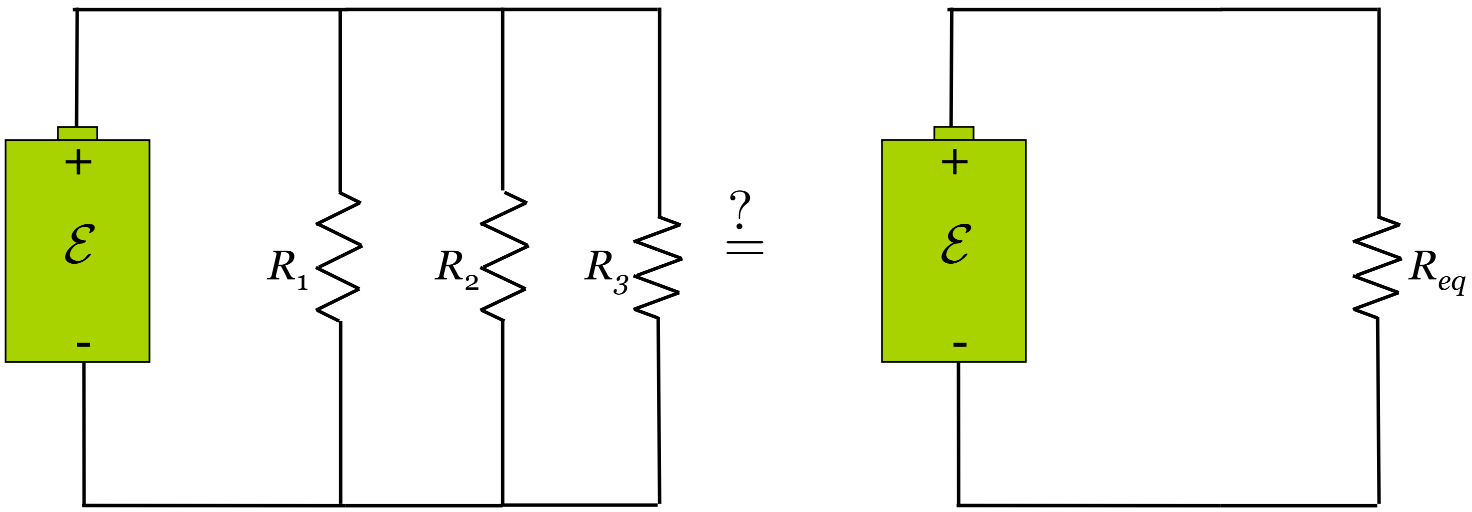
- YES!

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

31.6:
Parallel Resistors

What about several resistors in *parallel*…

- Can we find an *equivalent resistor*, R_{eq}, to the the resistors, R_1, R_2,…(all in *parallel*)?



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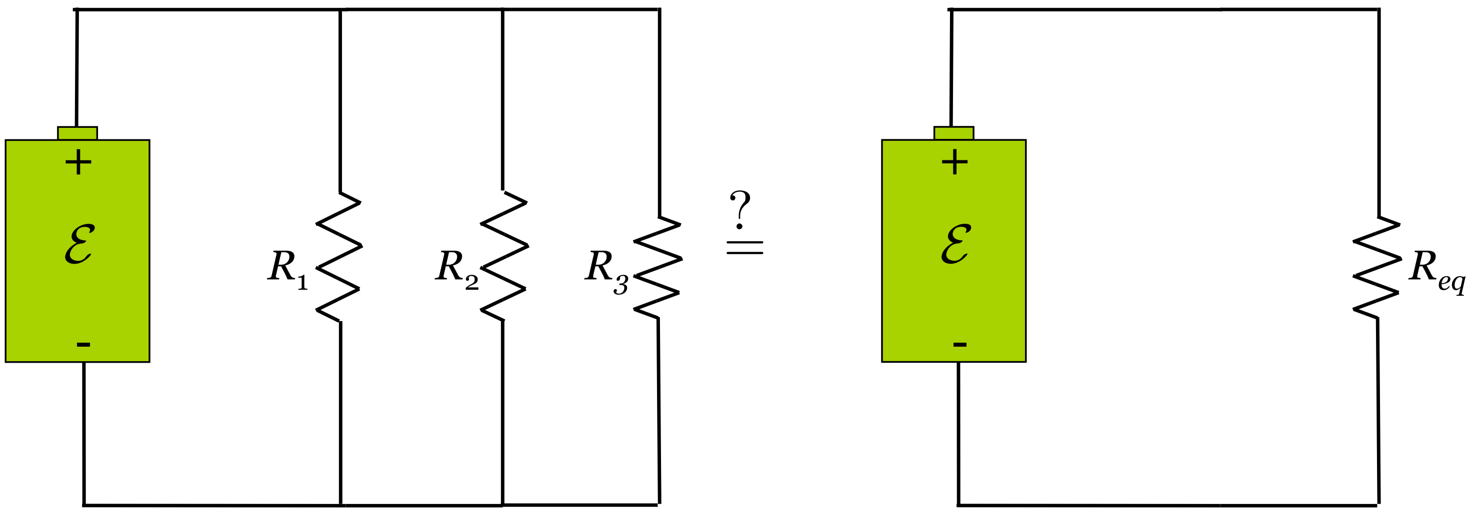


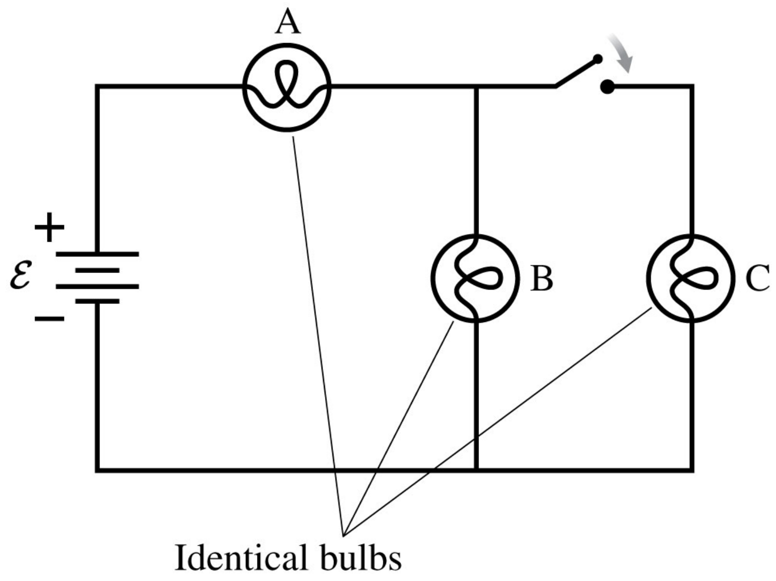
- YES!

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$$

Quiz Question 1, continued..

Consider the circuit below, where the switch is open. The current is the same through bulbs A and B, and they are equally bright. Bulb C is not glowing.

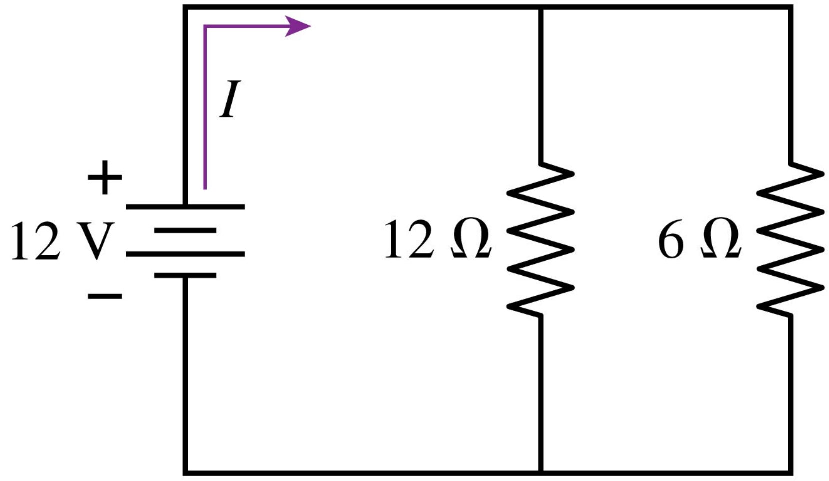
The switch is now closed, what happens to the brightness of A?



1. It increases.
2. It decreases.
3. It stays the same.

Quiz Question 2

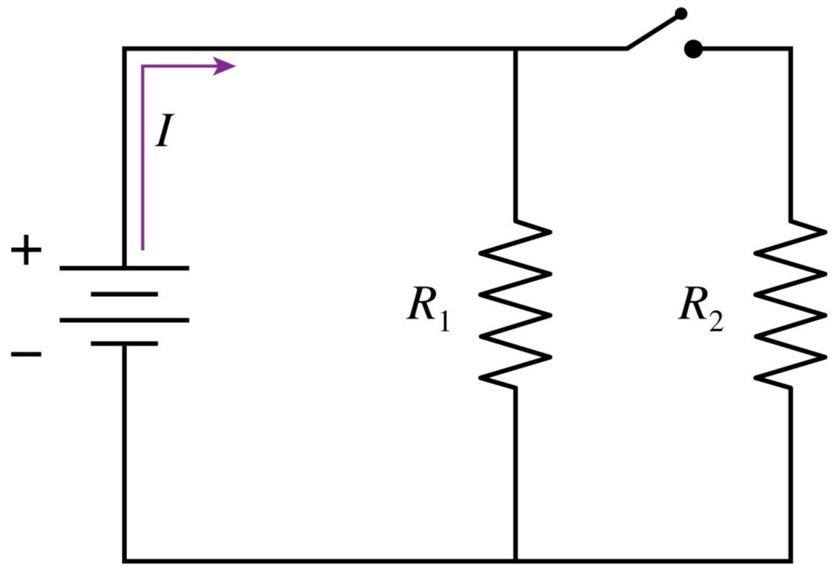
The battery current I is



1. 3 A.
2. 2 A.
3. 1 A.
4. 2/3 A.
5. 1/2 A.

Quiz Question 3

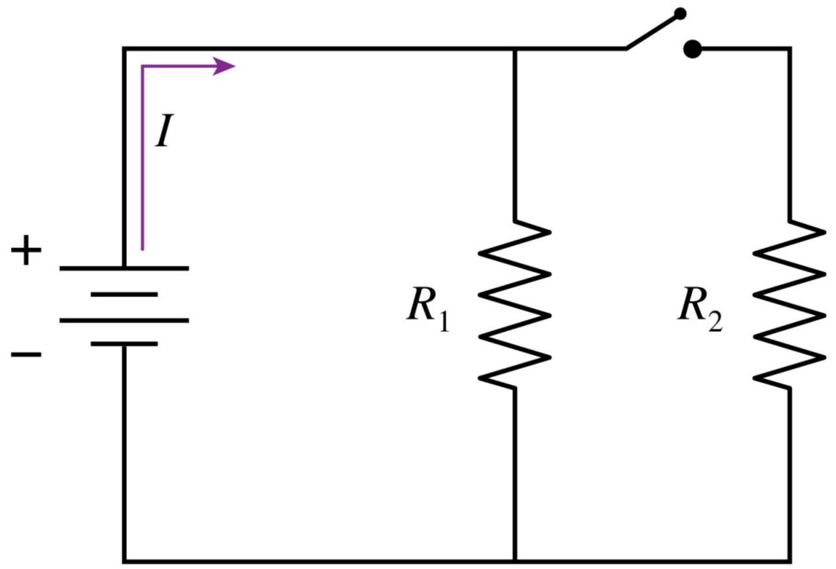
When the switch closes, the battery current



1. increases.
2. stays the same.
3. decreases.

Quiz Question 3

When the switch closes, the battery current



1. increases.
2. stays the same.
3. decreases.

Notice:

The equivalent of several resistors in parallel is *always less than* any single resistor in the group.